

Lunar Navigator - A Miniature, Fully Autonomous, Lunar Navigation, Surveyor, and Range Finder System

Microcosm, Inc.

Technical Abstract

Microcosm will use existing hardware and software from related programs to create a prototype Lunar Navigation Sensor (LNS) early in Phase II, such that most of the effort can be spent in extensive field-testing, making corrections as needed, and critical evaluation of the LNS performance on Earth and projected performance on the Moon. By using NGS survey markers, with centimeter-level position accuracy, as test sites, we expect to create a truth model for both absolute and relative position measurements that is essentially error free (relative to the LNS accuracy), thus allowing very accurate characterization of both random and systematic errors for both absolute and relative position measurements. This unambiguous characterization of the total error will allow validation (or correction) of the navigation error models and assessment of system performance with a high level of confidence. Additionally, the LNS prototype hardware is sufficiently small (roughly shoebox size with a laptop PC for data collection) and easy to set up (put on a tripod over the NGS marker), that it can easily be taken to multiple test locations. Finally, a detailed technology roadmap will be created showing how the TRL 6 LNS can be raised to TRL 9, ready for flight.

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Lightweight Hybrid Ablator Incorporating Aerogel-Filled Open-Cell Foam Structural Insulator, Phase II

Ultramet

Technical Abstract

In previous work for NASA and DoD, Ultramet developed lightweight open-cell foam insulators composed of a carbon or ceramic structural foam skeleton filled with a high temperature nanoscale aerogel insulator. Structural integrity and high insulation behavior have been demonstrated when used in combination with a non-ablating, coated carbon/carbon or ceramic matrix composite outer shell. In Phase I, Ultramet demonstrated the initial feasibility of a foam-reinforced hybrid ablator/aerogel insulator thermal protection system (TPS) in which a portion of the thickness (front face) of a low thermal conductivity structural foam was infiltrated with an ablative material and the remainder of the thickness (back face) was filled with the high temperature aerogel insulator. The potential benefit is a reduction in the ablator mass required to reject the aerothermal heat load. The three-dimensionally interconnected foam reinforcement is anticipated to provide increased char retention relative to alternative fiber and honeycomb reinforcements. The vehicle interface temperature will be controlled by the highly insulating aerogel-filled portion of the foam structure. In Phase II, Ultramet will team with Materials Research & Design (MR&D) for continued thermomechanical design optimization, and ARA Ablatives Laboratory for ablator infiltration of Ultramet structural foam. Performance will be evaluated through high heat flux ablation testing and a demonstration of scaleup potential up to 18" diameter.

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